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NATIONAL ANIMAL FEEDLOT WASTES RESEARCH PROGRAM

J. R. Shayler

Robert S. Kerr Water Research Center
Ada, Oklahoma

February 1973

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Environmental Protection Technology Series

National Animal Feedlot Wastes Research Program

National Environmental Research Center
Office of Research and Monitoring
U.S. Environmental Protection Agency
Corvallis, Oregon 97330

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EPA-R2-73-157
February 1973

NATIONAL ANIMAL FEEDLOT WASTES RESEARCH PROGRAM

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Project 13040 GJU
Program Element 1B2039

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NATIONAL ANIMAL FEEDLOT WASTES RESEARCH PROGRAM,

Shuyler, L. R.

13040 GJU

Environmental Protection Agency
Robert S. Kerr Environmental Research Laboratory,
Ada, Oklahoma

Environmental Protection Agency report
number EPA-R2-73-157, February 1973.

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The future plans of the program are presented on a PERT diagram. The time frame for the PERT diagram is dependent on funding and may be adjusted slightly in the future.

*Feedlots, *Animals, *Wastes, Water quality control, Pollution abatement, Planning

*National research program; *Animal feedlot wastes, Agricultural waste water

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ABSTRACT

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Key Words: Animal Feedlot Wastes, Water Quality, Pollution Control, Pollution Abatement, Agricultural Wastewater.

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SECTION I

SUMMARY AND CONCLUSIONS

This report presents the current status of the National Animal Feedlot Wastes Research and Development Program, including ongoing research projects and program goals, needs, milestones and future plans. Completed animal waste management research projects indicate several areas that require further investigation and have shown several promising systems for control of animal wastes. The historical practice of land disposal of these wastes has raised many questions relating to total salt buildup in soils at high application rates and to natural runoff quality from these disposal areas. Odors common to most handling, storage and disposal methods have created serious problems for some of the most promising control systems. New and innovative ideas and systems must be evaluated along with the more conventional systems for the control and management of animal wastes.

It is apparent that much work has been done in the area of animal waste control, but it is also evident that a monumental amount of research and demonstration work remains to be done if sound solutions are to be found for the many facets of the animal waste problem. The total environment (air, water, and solid waste) must be involved in the pollution control systems developed for use by the animal industry.

SECTION II

INTRODUCTION

Animal production enterprises attracted national attention as significant sources of water pollution during the last decade, with cattle feedlots receiving the greatest notice. Although farmers of the Midwest have been finish feeding small groups of animals for a number of years, the trend in animal production has changed to one of concentrated, confined "industrialized" operations for beef, swine and dairy cattle. This trend has resulted in a reduction in the total number of operations, but the concentration in animal production has magnified the pollution problems. Wastes produced from cattle feeding operations amount to approximately 110 million tons per year, from the dairy industry approximately 230 million tons per year, and from the hog feeding industry approximately 42 million tons per year. These figures do not account for the wastes produced from cow-calf operations, stocker calf enterprises, farrowing operations, and other miscellaneous animal operations.

During the period from 1960 to 1970 the number of fed cattle marketed increased from 13 to 25 million head (1), while total swine production increased only slightly from the 84 million slaughtered in 1960. During this 10 year period production methods have changed from many small operations with a few hogs in open shelters to slotted floor houses with large numbers of hogs at fewer locations. Dairy herd size has doubled in the last ten years, with the total number of dairy cows being reduced from 19 million to something less than 16 million; however, total milk production has increased (3).

All of these changes have been brought about by an increased population with a higher standard of living, demanding and receiving more and better quality food at relatively the same price. The resulting

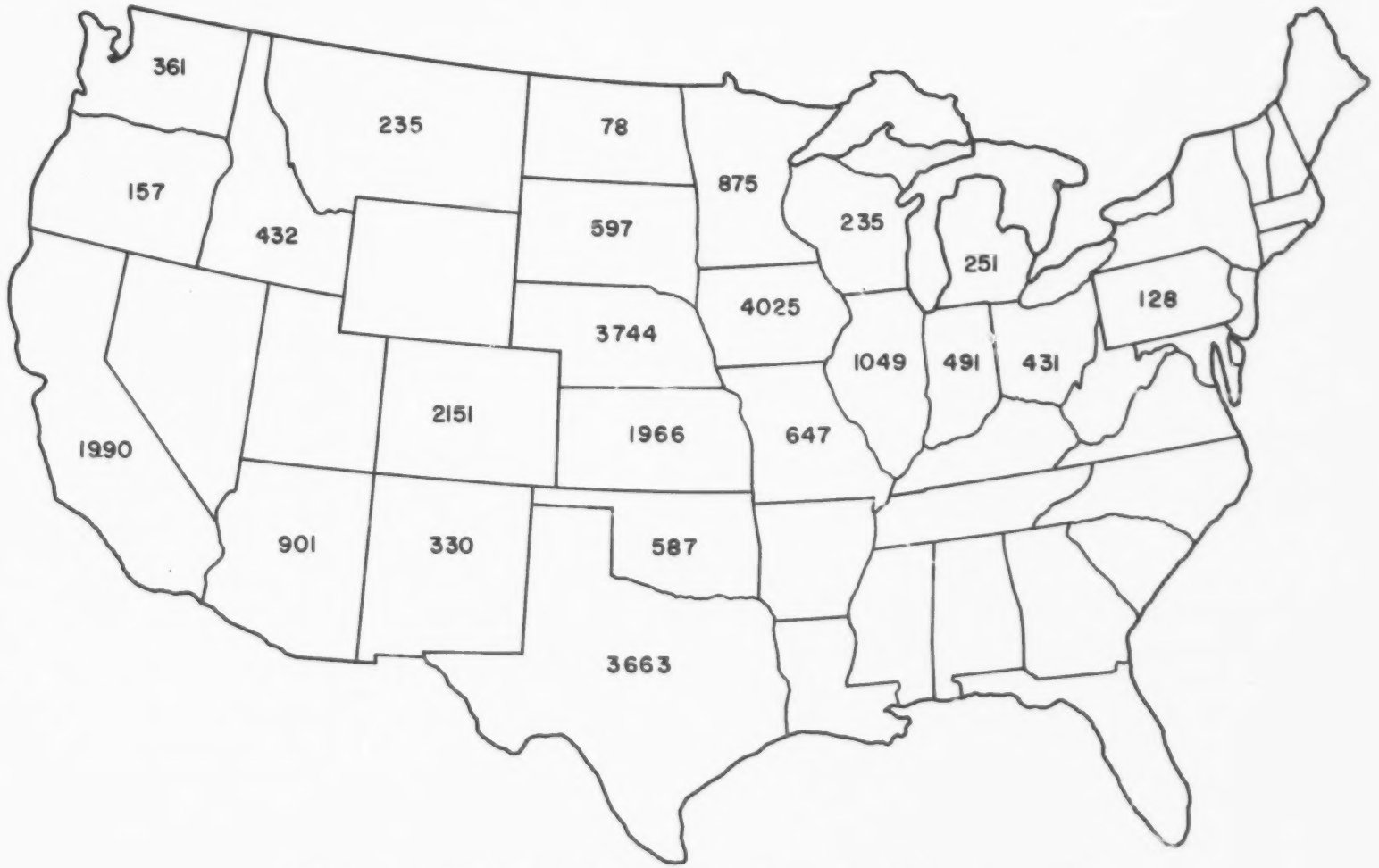


FIGURE 1 – FED CATTLE MARKETED IN 23 MAJOR STATES
1971
1,000 Head

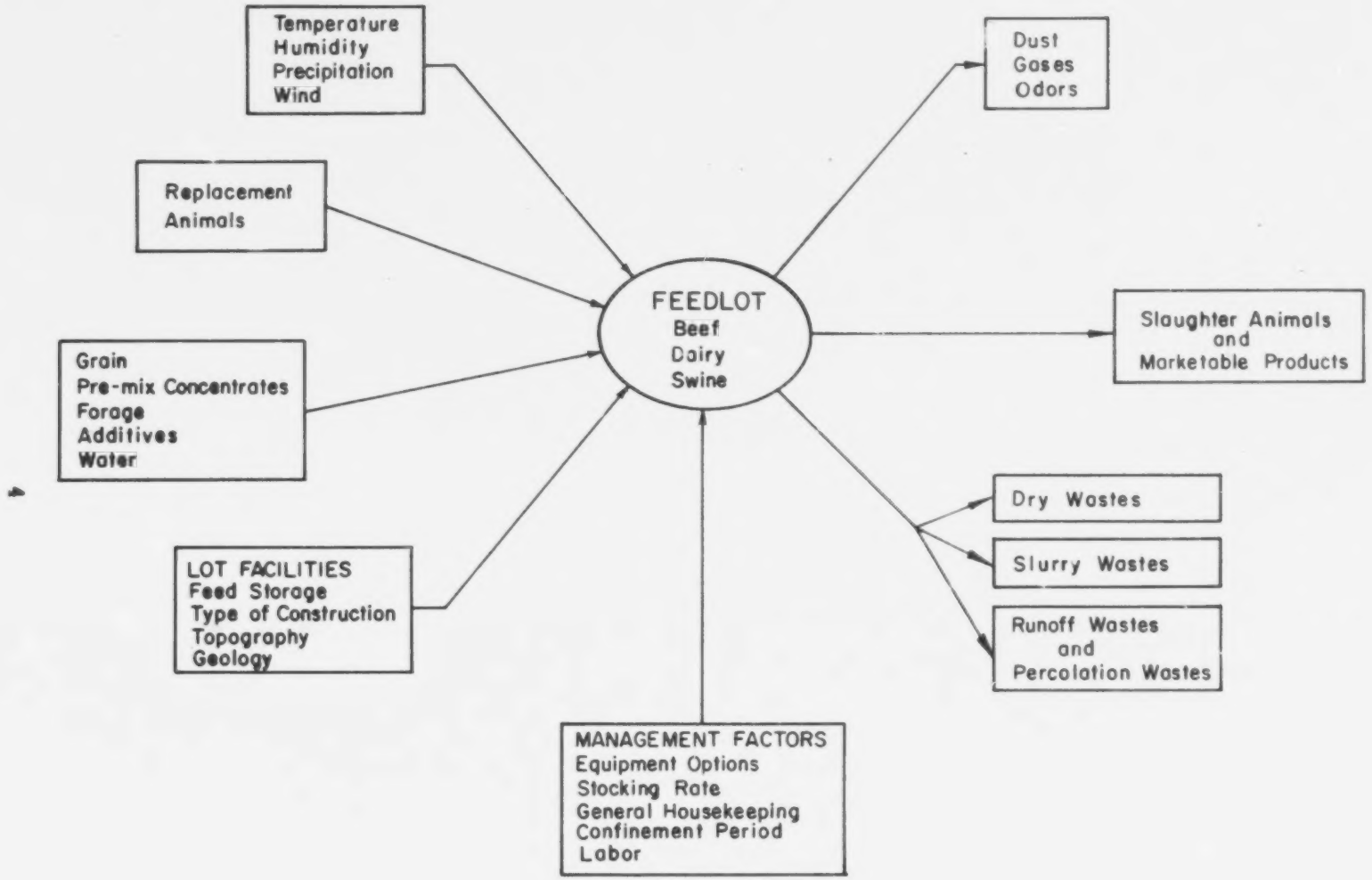


FIGURE 2 -
SCHEMATIC OF AN ANIMAL FEEDLOT SYSTEM

economic impetus dictated that producers of food commodities expand their operations to meet this demand. A myriad of economic and technical factors have worked together to produce large quantities of animal waste on very small land areas; not unexpectedly, these are often concentrated near population centers.

Essentially all the increase in the cattle feedlot industry has been in the form of large scale (10,000 head) operations. Large feedlots have greatly increased the efficiency of beef production but also have accented and enlarged the environmental problems. For each beef animal fed in a feedlot, the operator must dispose of nearly 3.6 tons of waste; a 10,000 head lot would have about 100,000 tons of manure per year that must be managed in some manner. In the mid-1960's water pollution caused by rainfall runoff from concentrated cattle feeding operations was reported as the cause of death for over 80 percent of the fish killed in one central state and was implicated in the transmission of a number of diseases (4, 5, 6).

Table I indicates the pollutional problems caused by feedlot runoff in a stream. A comparison of water quality parameters of two adjacent reservoirs, one of which received feedlot runoff following treatment by detention plus dilution in transit, is shown in Table II.

Fish kills are a visible indication of pollution. Nevertheless, the effect of animal wastes in streams may be very harmful to the ecological balance of the stream and still not cause fish kills. Moreover, long after a reported fish kill, the stream may not have recovered its normal condition because of manure deposition. In addition to Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chloride (Cl), Ammonia (NH_3) and Dissolved Oxygen (DO), other parameters must be considered when discussing animal waste pollution. Pathogenic Salmonella oganisms have been isolated from feces, runoff from animal confinement operations, carcasses of dead animals, and waterholes from which the animals drank (10-14). Two organisms, S. dublin and S. typhimurium were the salmonella organisms most

commonly found in the cattle and contaminated water investigated. S. dublin is essentially a pathogen of cattle but can cause meningitis and septicemia in humans. S. typhimurium, the pathogen which causes typhoid fever, can infect man and practically all species of birds and animals.

TABLE I

FOX CREEK NEAR STRONG CITY, KANSAS, NOVEMBER 1962
WATER QUALITY PARAMETERS (mg/l) (7)

TIME	DO	BOD_5	COD	Cl	NH_3
Avg. Dry Weather	8.4	2	29	11	0.06
After Rainfall					
13 hours	7.2	8	37	19	12.0
20 hours	0.8	90	238	50	5.3
26 hours	5.9	22	63	35	---
46 hours	6.8	5	40	31	0.44
69 hours	4.2	7	43	26	0.02
117 hours	6.2	3	22	25	0.08

TABLE II

WATERSHED RESERVOIRS AND FEEDLOT NEAR McKINNEY, TEXAS
WATER QUALITY PARAMETERS (mg/l) (8) (9)

	Min.	Mean Values			
	DO	BOD_5	COD	Cl	NH_3
Feedlot Runoff	--	2201	7210	450	108
Retention Pond Effluent	--	582	1980	314	63.4
Farm Pond Effluent	--	276	1379	240	35.0
Reservoir Receiving* F.R.**	0.0	46	61	29	1.7
Reservoir Without F.R.**	6.4	4.1	29	7.1	0.53

*Diluted in transit through Retention and Farm Ponds.

**F.R. = Feedlot Runoff.

SECTION III

RESEARCH NEEDS

In early 1967, the Federal Water Pollution Control Administration, subsequently a part of the Environmental Protection Agency, assigned the animal feedlot wastes (beef, swine, and dairy) research and development responsibilities to Robert S. Kerr Environmental Research Laboratory of Ada, Oklahoma. The goals of the program are to define the animal waste problem and its real and potential pollutional effects, to determine technically deficient areas of control, and to conduct and stimulate research, development, and demonstration of animal wastes pollution control technology.

In 1967, Dr. Raymond Loehr, Professor of Water Resources and Agricultural Engineering, Cornell University, under sponsorship of EPA (FWPCA) prepared a state-of-the-art document on pollution from animal wastes entitled "Pollution Implications of Animal Wastes--A Forward Oriented Review." This report defined the problem, reviewed existing technology, indicated gaps in knowledge, including engineering data (e.g. on waste composition), and recommended areas of research needs.

In order to provide a logical guide for research, development, and demonstration of an array of technically and economically effective waste management alternatives for animal producers to use in their operations, a system of needs priorities and implementations was devised. Research needs derived from a number of sources are listed below in order of implementation priorities.

High Priority Needs

The high priority research needs of the animal feedlot program are outlined in two general areas of work:

(1) The need to develop techniques for reprocessing or converting animal wastes into a usable product. Currently promising processes include conversion to some type of fuel, feed or feed additive for animals, or other by-product.

(2) The urgent need to make the current information on animal waste management readily available for widespread use by governmental agencies, the feeding industry, and researchers in the field. This objective will be accomplished by expanding an already existing abstract service and the development of waste management manuals and related literature.

The titles of the related needs statements and their associated identification numbers are listed below.

04 AAE Disposal of Rumen Residue by Conversion into Animal Feed.

09 AAJ Methods to Dispose of or Recycle the Manure.

04 AAE Utilization of Manure by Conversion to Animal Feeds.

06 AAM Effect of Refeeding Animal Wastes in Feedlots.

09 AAJ Symbiotic Integration of Agricultural Wastes in Hawaii.

04 AAE Kinetics of Growth and Substrate Removal by Microbes as Affected by Environmental Conditions in Batch Fermentation.

09 AAJ Investigations of Uses of Wastes from Agricultural Practices, Including Animal Wastes.

WRW Dissemination of Waste Management Information on Cattle Feedlots.

Medium Priority Needs

The medium priority needs of the animal waste program relate to control of ancillary pollutants from feedlots and to land disposal of animal wastes.

(1) The control of ancillary pollutants includes control and disposal of growth-promoting chemicals, antibiotics, heavy metals, dust, odors and other nuisance items characteristic of animal feeding operations.

(2) Land disposal of animal waste offers the only practical system of waste disposal at this time for the majority of operations. However, there are still many unanswered questions relating to loading rates, crops and soils. Treatment systems for disposal of part or all of the wastes from an animal production system must be developed and demonstrated. Two such systems have progressed to the pilot scale level and must be tested at full scale.

The titles of the related needs statements and their associated identification numbers are listed below.

07 AAE Environmental Hazard of Animal Growth Stimulants, Feedlot Medicines and Pesticides.

07 AAO Pollution from Animal Health and Growth Stimulants Subsequent to Excretion.

08 AAI Feedlot Odor Problems.

07 AAD Crop Response to Manure Disposal.

07 AAD Soil Response to Manure Disposal.

07 AAD Methods to Improve Cattle Feeding Techniques and Reduce Manure Production.

06 AKU Nitrate Buildup in Field Crops Receiving Feedlot Wastes.

06 ACQ Disposal of Feedlot Wastes.

09 AAJ Control of Drainage and Waste Water from Livestock Feedlots.

Low Priority Needs

The research needs in this category relate to control of pollutants for certain unique animal feeding enterprises and the demonstration of cattle management concepts to minimize pollution source problems.

Since the problem of snowmelt runoff has not received the attention given rainfall runoff, methods of control for this type of runoff have not been developed to date; these are needed in the northern climates.

A unique pollution control problem exists with an abandoned feedlot and also with a new feedlot just starting operation. These two types of lots can and do allow surface infiltration of moisture that carries with it very high concentrations of pollutants.

The titles of the related needs statements and their associated identification numbers are listed below.

07 AAF Techniques of Abandoned Feedlot Pollution Control.

10 ASJ Animal Feedlot Waste Treatment.

04 AAE Confined Animal Waste Disposal.

06 AAM Feedlot Waste Disposal.

07 ARW Demonstration of Improved Cattle Feedlot Management Techniques that Optimize Pollution Control.

07 AAD Manure Production Related to Feed and Environment.

06 AAM Optimum Cattle Feedlot Design.

SECTION IV

CURRENT RESEARCH AND DEVELOPMENT PROGRAM

Animal waste research is assigned to the National Animal Feedlot Wastes Research Program under Program Element B12039. Because of the increasing importance of animal feedlot pollution, regionally and nationally, all three research programs--Treatment and Control, Ground Water, and Water Quality Control--at the Robert S. Kerr Environmental Research Laboratory have been cooperating on specific in-house research activities.

To stimulate and guide the preparation of research grant proposals, a report entitled "Animal Feedlot Wastes Program Research Needs" was published in 1969; copies were distributed to research institutions throughout the United States. This report was revised for 1970 on the basis of research already funded, additional information relating to research priorities, and trends in animal production operations. The National Animal Feedlot Wastes Research Program is continually being restructured, not only to include pollution problems of current production methods as they arise, but also to encourage development of promising new management practices. Numerous consultations have been held with researchers and industry spokesmen in an effort to stimulate forward-oriented research.

Characterization of animal wastes was one of the early high priorities of feedlot research. Subsequent projects have essentially established waste characteristics to the extent that other aspects of the program are currently given more emphasis. Since August 1969, Treatment and Control Research and the National Water Quality Control Research Program have cooperated on projects at a 12,000 head cattle feedlot near McKinney, Texas. This facility, located 130 miles from Ada, was selected as one of the best designed non-paved feedlots available for the study of rainfall runoff.

At the time this study was initiated, information on feedlot runoff characteristics had been based mostly on artificial rainfall (sprinkler) conditions or a small number of grab samples of runoff. The McKinney study was to substantiate the results of these previous studies and to include additional parameters needed in the design of treatment or control facilities. Data from McKinney have shown that feedlot runoff from this site may not be as difficult to treat as had been believed. The direct runoff from the feed pens is, as previously reported, 10 to 15 times as concentrated as raw municipal wastes in terms of oxygen demand and solids; however, it was found that sedimentation resulting from only a few days retention in the runoff collection ponds reduced the amount of solids and the oxygen demand by about one half. In this special case, the concentrations of solids and the oxygen demand were reduced by 90 and 70 percent respectively, when both retention time and dilution from rainfall on the storage ponds were considered. The wastewater from this feedlot that actually must be treated is only 2 to 4 times the strength of raw municipal wastes. The data also suggest that the supernatant should be pumped from the collection ponds in a matter of a few days to prevent dissolution of the solids and an increase in the oxygen demand of the liquid.

The ditch-pond treatment system, as designed and operated by the feedlot management, was insufficient to treat feedlot wastewater. This was dramatically demonstrated by data collected for several months prior, during, and after a major fish kill in the downstream reservoir (see Table II).

The results of the McKinney studies were presented at the Purdue Industrial Waste Conference on May 7, 1970. The paper published in the proceedings and entitled "Characteristics and Effects of Cattle Feedlot Runoff" has been distributed (15). The final report of the project has been published.

Presently, almost all feedlots use the conventional approach to land disposal of animal wastes on the basis of irrigation and fertilizer needs.

Program personnel were instrumental in developing a research and demonstration grant (one of the first in the National Animal Feedlot Program) with Kansas State University to determine optimum design and loading parameters for land disposal of both liquid and solid wastes.

As early as the summer of 1969, Kerr Laboratory staff began planning a concentrated soil treatment system for feedlot runoff; construction on the project began at McKinney in June 1970. The treatment system is based on the principle of spray-runoff on sloped grassland used by Campbell Soup Company of Paris, Texas, other cannery plants, and some pulp and paper companies. This system produces a very good quality effluent from a high organic waste, and it is believed that adaptation to animal wastewater is quite feasible.

Preliminary results from the system at McKinney indicate that effluent discharged from this process is of sufficient quality to maintain current stream standards. The system is fully automated and uses only eight acres of treatment land for the runoff from 50 acres of feedlot. Modifications of the system can probably be applied in most areas of the United States although up to five months of waste storage may be required in the coldest climates. The system should be particularly adaptable to dairy and swine operations. Plans are under way to demonstrate and test this system with different wastes and in various climates in the United States.

One of the major problems of the program is the collection and dissemination of information to feedlot operators, regulatory agencies, consulting engineers, researchers, and others concerned with animal waste pollution. Several major steps have been initiated to alleviate this problem.

A grant to abstract all technical articles concerned with animal waste pollution has been awarded. Copies of the abstracts and articles are forwarded to the Robert S. Kerr Environmental Research Laboratory

and to the Water Resources Scientific Information Center (WRSIC). The Kerr Laboratory will maintain a reference library to aid in program planning and review of future research proposals. The WRSIC will prepare an annual publication of abstracts on animal wastes pollution for general distribution.

Oklahoma State University has been awarded a grant to anaylze the various current waste management alternatives available for cattle feedlot operation. The report shows these alternatives in relation to cost, climate, geology, land use, and other environmental factors. The report entitled "Evaluation of Beef Feedlot Waste Management Alternatives" has been published in the Clean Water Report Series.

The report from Oklahoma State has been used as a basis for two seminars conducted by the Kerr Laboratory personnel in the Northern and Southern High Plains during 1971. These seminars were used to provide design information on cattle feedlot waste management alternatives to those who can have the most immediate impact on water pollution abatement. Included in the groups were feedlot operators, consulting engineers, Agricultural Extension Service agents, state regulatory agency representatives, Soil Conservation Service engineers, and representatives of the Agricultural Stabilization and Conservation Service.

The program personnel are presently preparing for public distribution two animal feedlot manuals based on the Oklahoma State University report and other information generated by the research program.

Along with the above-mentioned activities, program personnel have given several papers on the need for and means of controlling animal feedlot pollutants at various feeder association meetings and other environmental conferences throughout the United States.

Current and past research projects related to animal waste management and sponsored by the Environmental Protection Agency are described on the following pages.

IN-HOUSE RESEARCH

1. "Runoff Characterization and Treatment Evaluation" (13040 PCN)

   Sponsor: Robert S. Kerr Environmental Research Laboratory
   Ada, Oklahoma

   Project Director: Marion R. Scalf

   Project Site: Meat Producers, Inc. Feedlot
   near McKinney, Texas

   Start Date: 1969 Completion Date: 1970

This research project determined the physical, chemical, and biological characteristics of runoff from a beef cattle feedlot. It also evaluated an existing treatment system being used by the feedlot.

The results indicated that the total amount of pollutants transported in feedlot runoff could be reduced approximately 50 percent by passing it through a settling basin prior to storage. The long naturally aerated oxidation ditch that was in use as a treatment system did not, in fact, provide any significant amount of treatment.

The final report on the project is complete and available through the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 PCN.

2. "Soil Treatment of Runoff From Beef Cattle Feedlots" (13040 RBQ-16080 WNU)

   Sponsor: Robert S. Kerr Environmental Research Laboratory
   Ada, Oklahoma

   Project Director: R. E. Thomas

   Project Site: Meat Producers, Inc. Feedlot
   near McKinney, Texas

   Start Date: 1969 Completion Date: 1972

This project is evaluating the effectiveness of the spray-runoff treatment process for treating rainfall runoff from a cattle feedlot. The system has not been in continuous operation because the feedlot is empty at times; however, when the system has operated it has been successful in producing an effluent that is satisfactory for stream discharge.

3. "Dissemination of Waste Management Information on Cattle Feedlots" (13040 WRW)

Sponsor: Robert S. Kerr Environmental Research Laboratory
Ada, Oklahoma

Project Director: Lynn R. Shuyler

Project Site: Ada, Oklahoma

The program staff at Ada has held two regional cattle feedlot waste management seminars which have produced a manual to aid in the location of animal feeding operations, considering all envionment factors of an area. The "Animal Feedlot Site Selection for Environmental Protection" manual is now available from the Government Printing Office and at the Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma.

The staff is also preparing a design manual for beef cattle waste management to be available early in 1973.

CONTRACT RESEARCH

4. "State-of-the-Art Animal Wastes" (14-12-88)

Contractor: Dr. Raymond C. Loehr

Location: Lawrence, Kansas

Start Date: 1967 Completion Date: 1968

This contract resulted in a state-of-the-art paper on animal wastes. It described the characteristics of the wastes, both physical and chemical. It also revealed many areas of needed research in the animal wastes field.

This report, entitled "Pollution Implications of Animal Wastes--A Forward Oriented Review," has received wide distribution and is now available from the Robert S. Kerr Environmental Research Laboratory at Ada, Oklahoma.

5. "Characteristics of Wastes from Cattle Feedlots in the Southwest" (13040 DEM)

Grantee: Texas Tech University
Water Resources Center
Lubbock, Texas

Project Site: Lubbock Texas

Start Date: 1969 Completion Date: 1970

This project was designed to determine the characteristics of wastes from southwestern cattle feedlots, to evaluate waste control and removal techniques and to develop criteria for the design and operation of feedlots to minimize water pollution.

The study produced information indicating that the quantity of waste could be reduced by 50 percent by reducing the roughage from 12 percent to five percent. It also indicated that sloping concrete pens could be designed to self clean by hoof action of the cattle.

The final report, entitled "Characteristics of Wastes from Southwestern Cattle Feedlots," is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 DEM. Limited copies are also available at the Kerr Laboratory.

6. "Demonstration and Development of Facilities for the Treatment and Ultimate Disposal of Cattle Feedlot Wastes" (13040 DAT)

Grantee: Kansas State University
Manhattan, Kansas

Project Site: Pratt Feedlot, Inc.
Pratt, Kansas

Start Date: 1969 Completion Date: 1973

The objectives of this project were to determine optimum loading rates for the land disposal of both solid and liquid feedlot wastes in relation to the effect on soils, crops, and runoff water from the disposal area. The preliminary results have revealed an excessive amount of salt in

the soil beneath some of the plots. The study is bracketing the maximum amounts of manure and runoff that can safely be applied to the soil.

7. "Animal Waste Management--Demonstration of Feasible Handling and Treatment Processes" (13040 DDG)

Grantee: Cornell University
Ithaca, New York

Project Site: Ithaca, New York

The objective of this study was to design, construct and demonstrate the applicability of a treatment system, based upon laboratory results, for the removal of organic matter, nitrogen, phosphorus, and color from poultry and dairy cattle wastewater. The facilities developed in Phase I of this project are being used to evaluate other treatment systems.

The Phase I report is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 DDG.

8. "Closed System Waste Management for Livestock" (13040 DKP)

Grantee: Michigan State University
East Lansing, Michigan

Project Site: East Lansing, Michigan

Start Date: 1970 Completion Date: 1971

The main objective of this study was to determine the necessary engineering design parameters for a self-contained, automated animal waste management system for cattle and swine wastes. The study produced a very effective method of separation of the solid and liquid fractions of the wastes by using a vibrating screen.

The final report of this project is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 DKP.

9. "The Utilization/Disposal of Cattle Feedlot Wastes by Pyrolysis" (13040 ECH)

Grantee: Midwest Research Institute
Kansas City, Missouri

Project Site: Kansas City, Kansas

Start Date: 1970 Completion Date: 1971

This project evaluated the technical and economic feasibility of pyrolysis as a method of cattle feedlot waste utilization and disposal. The results indicated that the system is technically feasible, although considerable study of the engineering problems of the system is needed. However, the economic study indicated the process was unfeasible at the time.

The final report is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 EGH.

10. "Automated System for Water Pollution Control from an Animal Production Unit" (13040 EOL)

Grantee: Ohio State University
Columbus, Ohio

Project Site: Botkins, Ohio

Start Date: 1970 Completion Date: 1973

The objectives of the project are to develop and demonstrate an automated oxidation ditch treatment of hog wastes with recirculation of effluent for flushing water. The system will provide design information for other less elaborate systems.

11. "Abstract Service on Animal Waste Technical Literature" (13040 FUU)

Grantee: Iowa State University
Ames, Iowa

Project Site: Ames, Iowa

Start Date: 1969 Completion Date: 1972

The abstract service was established to provide a reference library of technical articles concerned with water pollution from animal

wastes. The library is located at the Robert S. Kerr Environmental Research Laboratory. The abstracts will be published annually by the Water Resources Scientific Information Center.

12. "Demonstration of a Waste Treatment System for Confined Hog-Raising Operations" (13040 EVM)

Grantee: Schuster Farms
Gower, Missouri

Project Site: Gower, Missouri

Start Date: 1970 Completion Date: 1972

This project demonstrated how a collection, aeration treatment, and land disposal system could be designed and constructed for an existing 800 head confined hog-feeding operation. The system has operated very successfully to date and has proven that additional treatment prior to disposal is feasible.

13. "Swine Waste Treatment System Using a Rotating Biological Contactor" (13040 ERR)

Grantee: Iowa State University
Ames, Iowa

Project Site: Ames, Iowa

Start Date: 1971 Completion Date: 1972

The project is demonstrating and evaluating the use of a lagoon system plus the addition of a rotating biological contactor for the treatment of swine waste. The water from the contactor is recycled and used in a flush system in the swine houses. The system has worked very satisfactorily to date.

14. "Evaluation of Beef Feedlot Waste Management Alternatives" (13040 FXG)

Grantee Oklahoma State University
Stillwater, Oklahoma

Project Site: Stillwater, Oklahoma

Start Date: 1970 Completion Date: 1971

This grant project involved visiting and studying the waste management of a great number of feedlots located in all parts of the United States. The report compares, from both an economical and a technical viewpoint, the current waste management alternatives being used by the feedlots visited. The systems were evaluated on the basis of the feedlot design, the topography at the location, local climate, and other environmental variables.

The report is complete and is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 FXG..

15. "Soil Modification for the Denitrification and Phosphate Reduction of Feedlot Wastes" (13040 FYK)

Grantee: Michigan State University
East Lansing, Michigan

Project Site: East Lansing, Michigan

Start Date: 1971 Completion Date: 1973

This research project is to evaluate the potential of the soil as a treatment system for the removal of nitrogen and phosphate from both dairy and swine wastes. The system consists of a plastic barrier placed six feet below the soil surface with drain lines located two feet above the barrier. Liquid waste, applied to the surface, moves downward through the soil and is recovered from the drain lines.

16. "Design Criteria for Swine Waste Treatment System" (13040 GDD)

Grantee: North Carolina State University
Raleigh, North Carolina

Project Site: Raleigh, North Carolina

Start Date: 1971 Completion Date: 1973

The project is to provide specific design data for anaerobic lagoons in the Southeast. The lagoon systems being investigated are single cell lagoons, series lagoons, and aerated lagoons. The effluent from these systems will be distributed on land for final disposal.

17. "Waste Treatment Facilities Demonstration" (13040 FTX)

Grantee: Union Stockyards Company
West Fargo, North Dakota

Project Site: West Fargo, North Dakota

Start Date: 1970 Completion Date: 1972

The objective of this study was to evaluate stabilization ponds for the treatment of stockyard wastes. These wastes were generated from the pens, the alleys, and the truck-cleaning operations.

The final report from this project is available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 FTX.

18. Proceedings for "Conference on the Role of Agriculture in Clean Water" (13040 EYK)

Grantee: Iowa State University

This grant supported the publication of the proceedings of the conference. The proceedings are available from the Government Printing Office, Washington, D.C., Water Pollution Control Research Series, 13040 EYX, and from Iowa State University Press, Ames, Iowa.

19. "Pollution Abatement from Cattle Feedlots in Northeastern Colorado and Eastern Nebraska" (13040 DPS)

Grantee: Agricultural Research Service, USDA

Project Site: Fort Collins, Colorado, and Lincoln, Nebraska

Start Date: 1970 Completion Date: 1973

This joint effort was conceived to investigate the extent and kinds of pollutants generated and released from a feedlot. Total moisture and nutrient balances are being measured on several feedlots to determine the fate of the pollutants. Extensive core sampling below the feedlot surface has indicated very little movement of pollutants below the feedlot if a manure pack is established and not disturbed; however, if the lot is abandoned serious problems are encountered. Studies have also been made to determine the amount and extent of airborne pollutants.

20. "A Method for Dissemination of Animal Waste Management Technical Information" (801454)

Grantee: East Central State College, Ada, Oklahoma

Start Date: 1972 Completion Date: 1973

The project is to gather published material related to management and pollution control of livestock, poultry and fish wastes, to abstract this material, and to make it available to potential users. Abstracts will be submitted to the Water Resources Scientific Information Center (WRSIC) and will be published in Selected Water Resources Abstracts. In addition, a bibliography of all abstracted material will be published by EPA yearly. The entire file of data will be available through the grantee and the Robert S. Kerr Environmental Research Laboratory.

21. "Conversion of Cattle Feedlot Waste to Ammonia Synthesis Gas" (801065)

Grantee: Texas Tech University

Start Date: 1972 Completion Date: 1973

This project will determine the technical and economic feasibility of abating cattle feedlot pollution by converting cattle manure into synthesis gas to be used for subsequent ammonia production. The study will determine the design values for the following parameters: (1) heat of combustion, (2) composition, (3) moisture content, (4) heat capacity data, (5) projected equilibrium yields. The data obtained from these investigations will be used to formulate process design information for a pilot scale operation.

22. "Feedlots/Affected/Environment/Ration/Animal Management" (800302)

Grantee: Gulf Coast Development Corporation
Bay St. Louis, Mississippi

This project is designed to demonstrate the effect of (1) feed roughage concentration, (2) confinement housing facility type, and (3) animal density, on waste management systems, costs, and beef cattle feed/gain efficiencies.

The project will require 24 months of continuous operation and be conducted in three phases with repeated feed cycles, as outlined above. Three different waste management schemes will be evaluated in each phase, based on (1) wastes mixed with rainfall runoff, (2) slurry wastes from slotted and paved floors, and (3) solid wastes.

23. "Liquid Aerobic Compositing of Cattle Waste and Evaluation of By-products" (S-801647)

Grantee: Chino Basin Municipal Water District
Chino, California

The primary objective of the project is to demonstrate the technical and economic feasibility of treating livestock wastes by means of a sequential thermophilic-mesophilic aerobic stabilization process to produce (1) an innocuous, settleable humus with ion-sequestering ability suitable as a soil conditioner, and (2) a nearly odor-free, pathogen-free supernatant usable for irrigation or flushing. The digestions will be carried out in bench scale vessels with fresh wastes collected and processed on-site. Process parameters needed for construction of a mathematical model will be measured and a usable computer model of the process will be attempted. In addition, the amount of heat generated by the process will be measured to determine if it is self-sustaining. From the bench scale experiments, design data and operating requirements for a plant capable of treating wastes from 500 head of cattle will be developed and estimates of the economics of this system made.

SECTION V

FUTURE RESEARCH AND DEVELOPMENT PROGRAM PLANS AND OBJECTIVES

Based on the need statements, the current status and future trends in the animal feeding industry and the public environmental awareness, the major emphasis in the National Animal Feedlot Waste Research Program are divided into six areas of concern:

I. Development and Demonstration of Reprocessing and Reuse Systems for Animal Wastes.

II. Demonstration of Land Disposal/Treatment Concepts for Animal Wastes from Small Operations.

III. Development and Demonstration Measures to Control Ancillary Pollutants from Animal Feedlots.

IV. Identification of, Impact of, and Control Techniques for, Pollutants from Certain Animal Feeding Enterprises.

V. Development and Demonstration of Animal Management Concepts which Minimize Pollution Source Problems.

VI. Information and Guidelines Governing Animal Wastes.

Each of these major areas will be discussed in detail as follows:

I. Reprocessing and Reuse Systems for Animal Wastes.

Recent trends in the animal feeding industry and the increasing public concern about the environment suggest that waste control systems should adapt themselves to the closed-loop principle, including the recovery or reuse of the wastes produced. In many cases the concept of land disposal is not satisfactory for the larger feeding enterprises. Moreover, as the urban population moves into the previously rural

areas, waste disposal becomes critical in determining the survival of animal production operations in their present locations. As examples, some possible research projects are listed below. This list is by no means complete or final.

A. Develop and demonstrate economically feasible processes for manufacture of feeds or feed additives from animal excreta.

B. For each excreta-derived feed product, determine metabolic balance, daily requirement, and palatability for each possible consumer animal species.

C. Research and demonstrate economic processes for conversion of animal waste into oil and/or gas for replacement of fossil fuel sources.

II. Land Disposal and/or Treatment Concepts for Animal Wastes from Small Operations.

Even though the trend in the feeding industry is to larger production units, the smaller units outnumber them by a ratio of about 7 to 1. These small units have the same pollution problems as the large operations but in many cases cannot economically afford the same control systems. The objectives of this planning unit are to develop and demonstrate an array of waste control systems that will satisfy the needs of the smaller production units. Three possible projects in this category are listed; additional concepts are solicited.

A. Demonstrate and evaluate the spray runoff treatment system under diverse climatic conditions and for wastes from various types of production units.

B. Demonstrate and evaluate containment, stabilization, and land disposal of all wastes generated from small operations in cold climates and high rainfall areas. Projects of this type might consider modification of concepts in use today on larger operations to meet the needs of the small operators both in terms of size of facilities and the economics of the system.

C. Demonstrate and evaluate the barriered land filter treatment system for treatment of animal wastes. Variations of this system can be used with both liquid and slurry wastes.

III. Develop Measures to Control Ancillary Pollutants from Animal Feedlots.

The modern rations now being used by animal feeders include growth hormones, antibiotics, and heavy metals. Portions of these additives, their breakdown products, and/or their matabolites are excreted by the livestock. The control and treatment of these substances is necessary to insure safe reuse of the waste. Other nuisances such as dust, odors, and vectors must also be controlled in order to insure complete environmental harmony between the animal feedlots and the surrounding neighborhood.

A partial list of possible projects is given below..

A. Determine minimum required intake rates of all non-nutritional substances presently used or contemplated for use in animal feeding operations including growth promoters, antibiotics, salts, pesticides, etc.

B. Determine buildup rates of growth promoters, antibiotics, salts, and pesticides in soils used for disposal and establish levels at which these substances become inimical to soil microorganisms, animals and aquatic life.

C. For the various facility designs of each branch of the animal feeding industry, develop and demonstrate dust and odor control techniques applicable to diverse climatic conditions.

IV. Identify Impact of and Control Techniques for Pollutants from Certain Animal Feeding Enterprises.

Pollution problems encountered when starting a new feeding operation and when abandoning a feedlot are very different from those of an

operational feedlot. A second important problem is that of minimizing pollution from an unused or abandoned feedlot site. The slow release of pollutants from runoff and decay may require control or renovation measures, e.g. plowdown and crop planting, maintenance of detention and treatment structures, etc. At present, neither the extent of the problem nor the efficiency of the proposed control methods has been quantified. A third problem specific to animal producers in northern climates is that of control and disposal of snowmelt runoff. Characterization of runoff under some snowmelt conditions has been accomplished; however, techniques for its containment and disposal have yet to be developed.

As examples, some of the possible projects are listed below. This list is by no means complete or final.

A. Characterize pollutants and develop and demonstrate control methods for runoff resulting from snowmelt and frozen surface conditions from feedlots in several areas of the northern United States.

B. Characterize pollutants, develop and demonstrate control methods for rainfall runoff and water infiltrating the feedlot surface from both new feedlots and abandoned feeding facilities at various locations in the established feeding areas.

V. Cattle Management Concepts which Minimize Pollution Source Problems.

Animal producers have continually been trying, with the help of universities, to develop new facilities and feed rations. Some of these developments have incorporated unique feed and waste handling techniques. This planning unit will attempt to evaluate these present ideas and develop and demonstrate other new and unique facilities, feed rations, animal manipulation methods, feed distribution systems, manure removal methods, and nuisance control methods.

One example of a project for this unit might include a complete field station for the development of the techniques described above. A second approach to this plan would be to evaluate these systems at existing facilities in feeding areas of the United States.

VI. Dissemination of Information and Guidelines Governing Animal Wastes.

A crucial need is a comprehensive system for compilation and dissemination of animal waste management information for use by federal, state, and private institutions as well as individual animal producers.

A complete library of the abstracts of all recent animal waste literature has been established at the Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma; this collection is continually updated. It is anticipated that these files will be put on microfilm in the near future and will hence be more useful to the entire industry.

The scope of future projects in this area will include the following:

A. National seminars for animal wastes control and management concepts.

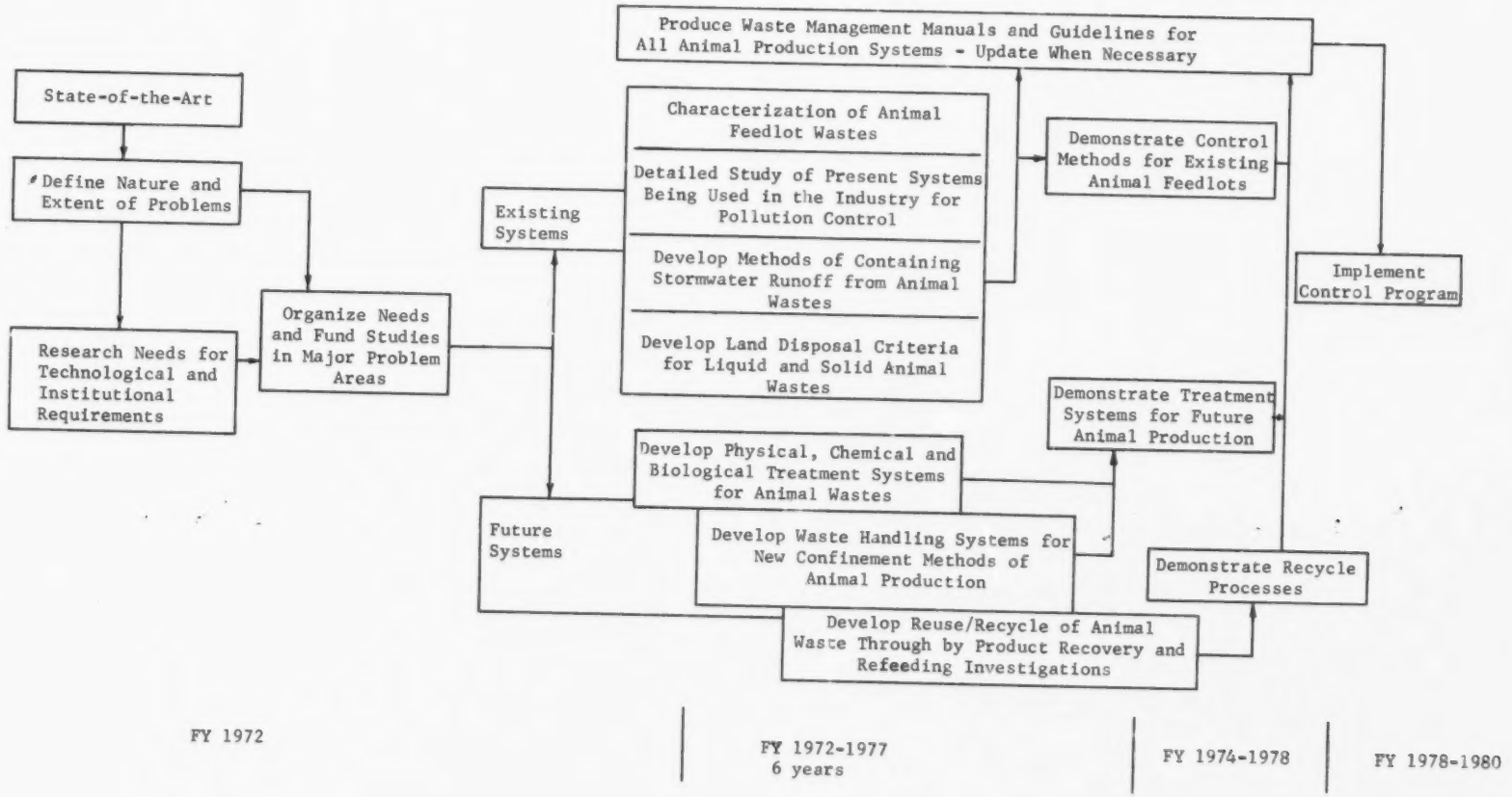
B. Establishment of mass media dissemination of current wastes management or control methods by means of spot radio and television broadcasts, periodic newsletters, and other printed material.

C. Development of wastes management manuals for each species of animal to disseminate current environment protecting wastes control and management practices. These must be updated biennially.

FIGURE 3 -

NATIONAL ANIMAL FEEDLOT WASTES RESEARCH AND DEVELOPMENT PROGRAM

Goals and Milestones


Produce Waste Management Manuals and Guidelines for All Animal Production Systems - Update When Necessary
State-of-the-Art
Define Nature and Extent of Problems
Research Needs for Technological and Institutional Requirements
Organize Needs and Fund Studies in Major Problem Areas
Existing Systems
Characterization of Animal Feedlot Wastes
Detailed Study of Present Systems Being Used in the Industry for Pollution Control
Develop Methods of Containing Stormwater Runoff from Animal Wastes
Develop Land Disposal Criteria for Liquid and Solid Animal Wastes
Demonstrate Control Methods for Existing Animal Feedlots
Implement Control Program
Demonstrate Treatment Systems for Future Animal Production
Develop Physical, Chemical and Biological Treatment Systems for Animal Wastes
Future Systems
Develop Waste Handling Systems for New Confinement Methods of Animal Production
Demonstrate Recycle Processes
Develop Reuse/Recycle of Animal Waste Through by Product Recovery and Refeeding Investigations
FY 1972
FY 1972-1977
6 years
FY 1974-1978
FY 1978-1980

SECTION VI

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